

What is claimed is:

1. A polyurethane with primary aliphatic isocyanate crosslinking and exhibiting at least one of the properties selected from the group consisting of a flexural modulus of 1.0×10^8 pascals or less, a storage modulus of 1.0×10^8 pascals or less,
5 a Shore A hardness of less than 94, a Hoffman scratch-hardness test result of 2 or less, and a color shift, in accordance with heat aging test ASTM D2244-79, within 1 delta E.
2. A polyurethane as recited in claim 1, wherein said polyurethane is based on at
10 least one of the polymers selected from the group consisting of polyesters, polycarbonates, polyacrylates, and polyethers.
3. A polyurethane as recited in claim 2, wherein said polyurethane is based on
15 polyester.
4. A polyurethane as recited in claim 2, wherein said polyurethane is based on a copolymer of at least two of said polymers.
5. A polyurethane as recited in claim 4, wherein said polyurethane is based on a
20 copolymer of polyester and up to about 20 weight percent polyether.
6. A polyurethane as recited in claim 1, wherein said polyurethane has at least about 25 weight percent primary polyisocyanate crosslinking.

22. A polyurethane as recited in claim 7, wherein said polyurethane has a storage modulus of 1.0×10^8 pascals or less.

5 23. A polyurethane as recited in claim 7, wherein said polyurethane has a flexural modulus of 1.0×10^8 pascals or less.

24. A polyurethane as recited in claim 14, wherein said reaction product, upon exposure to moisture or carboxyl groups, does not exhibit a substantial amount
10 of outgassing in the cured polyurethane.

25. A polyurethane as recited in claim 7, wherein said reaction product has polyether segments of about 20 weight percent or less.

Sub B1 15 26. An article comprising:
(a) a substrate, and
(b) a polyurethane applied as a layer on a surface of said substrate, said polyurethane is a reaction product of,
(i) a first component including one or more polyols having an
20 equivalent weight in the range from about 28 to about 3000, optionally one or more diols having an equivalent weight in the range from about 30 to about 4000, and a catalyst; and
(ii) a second component including a primary aliphatic isocyanate crosslinker wherein the first and second components together are solvent
25 free.

27. An article as recited in claim 26, wherein said substrate is polymeric material, wood, fabric, reinforced polymers, metal, or combinations thereof.

Sub B2 30 28. An article as recited in claim 26, wherein an adhesive is applied onto an opposite side of said substrate.

Sub B2
29. An article as recited in claim 26, further comprising indicia applied onto a surface of said substrate and covered by said polyurethane.

5 30. An article as recited in claim 26, wherein said indicia is three dimensional.

31. An article as recited in claim 26, wherein said polyurethane layer covers the entire surface of said substrate and the indicia.

10 32. An article as recited in claim 30, wherein said three dimensional indicia comprises a cured polyurethane body having a mounting surface, a tie layer bonded to the mounting surface of said cured polyurethane body, and an adhesive body adhered to the tie later.

15 33. An article as recited in claim 26, wherein said substrate is a base substrate and one or more secondary articles are applied over said base substrate, each of said secondary articles comprising an adhesive attachment system, a substrate, and indicia.

20 34. An article as recited in claim 33, wherein said base substrate includes indicia and said secondary articles are applied over the indicia of said base substrate.

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35. An article as recited in claim 33, wherein said one or more secondary articles include three dimensional articles.

25 36. An article as recited in claim 26, wherein said catalyst is a tin-based catalyst and said polyurethane, upon exposure to moisture or carboxyl groups, does not exhibit a substantial amount of outgassing.

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7. A flexible polyurethane comprising:
a reaction product of,
(a) a first component including one or more polyols having an equivalent
weight in the range from about 28 to about 3000, optionally one or more
diols having an equivalent weight in the range from about 30 to about 4000,
and a catalyst; and
(b) a second component including a primary aliphatic isocyanate crosslinker
wherein the first and second components together are solvent free.
8. A polyurethane as recited in claim 7, wherein said reaction product has a
viscosity in the range from about 400 cps to about 5000 cps at 25° C.
9. A polyurethane as recited in claim 7, wherein said reaction product has a
viscosity in the range from about 600 cps to about 4000 cps at 25° C.
10. A polyurethane as recited in claim 7, wherein said one or more polyols and
said one or more diols are selected from the group consisting of polyesters,
polycarbonates, polyacrylates, and polyethers or combinations thereof.
11. A flexible polyurethane as recited in claim 7, wherein said primary aliphatic
isocyanate crosslinker is a polyisocyanate of at least about 50 weight percent of
the second component.
12. A polyurethane as recited in claim 7, wherein said reaction product, upon
curing, has a Shore A hardness of about 94 or less at room temperature.
13. A polyurethane as recited in claim 7, wherein said catalyst is included in
said first component in an amount of at least about 200 ppm.

14. A polyurethane as recited in claim 7, wherein said catalyst is a tin-based catalyst.

5 15. A polyurethane as recited in claim 7, wherein said tin-based catalyst is selected from the group consisting of dibutyltin diacetate, dibutyltin dilaurate, dibutyltin diacetylacetonate, dibutyltin dimercaptide, dibutyltin dioctoate, dibutyltin dimaleate, dibutyltin acetylacetonate, and dibutyltin oxide.

10 16. A polyurethane as recited in claim 7, wherein said first component comprises in the range of greater than from about 10 weight percent of said one or more polyols.

15 17. A polyurethane as recited in claim 7, wherein said first component comprises in the range up to about 65 weight percent of said one or more diols.

18. A flexible polyurethane as recited in claim 7, wherein said one or more diols includes a short chain diol having an equivalent weight in the range from about 30 to about 400, and a polymeric diol having an equivalent weight in the range from about 400 to about 4000.

20 19. A polyurethane as recited in claim 7, wherein said isocyanate is a blocked isocyanate.

25 20. A polyurethane as recited in claim 7, wherein said first component includes one or more compounds selected from the group consisting of antioxidants, moisture scavengers, antifoaming agents, ultraviolet light absorbers, hindered amine free radical scavengers, leveling agents, decorative solids, and coloring agents.

30 21. A polyurethane as recited in claim 7, wherein said polyurethane has a surface with a Hoffman scratch-hardness test result of 2 or less.

37. A method of producing a polyurethane, comprising:

- reacting a first component and a second component, wherein said first component includes a polyol having an equivalent weight in the range from about 28 to about 3000, optionally, one or more diols having an equivalent weight in the range from about 30 to about 4000, and a catalyst and said second component includes a primary aliphatic isocyanate crosslinker, wherein said first and second components together are solvent free.

Adol
B₃

Adol
C₁

Adol
D₅

Adol
E₃

Adol FS